INITIAL EVALUATION AND TRIAGE

KEY ELEMENTS
- Triage patients with possible acute myocardial infarction (MI) or unstable angina for evaluation and treatment
- Initiate O_2, intravenous access and continuous ECG monitoring
- Institute advanced cardiac life support (ACLS), if indicated
- Obtain 12-lead electrocardiogram (ECG)
- Perform expedited history & physical to:
  - R/O alternative catastrophic diagnoses (pericarditis, pericardial tamponade, thoracic aortic dissection, pneumothorax, pancreatitis, & pulmonary embolus)
  - Elicit characteristics of MI
  - Determine contraindications to reperfusion therapy
- Administer the following:
  - Non-coated aspirin (160 to 325 mg).
  - Nitroglycerin (spray or tablet, followed by IV, if symptoms persist).
  - Beta-blockers in the absence of contraindications
- Determine if patient meets criteria for emergent reperfusion therapy:
  - History of ischemia or infarction, and
  - ECG finding of ongoing ST-segment elevation in 2 or more leads or left bundle branch block (LBBB)
- Ensure adequate analgesia (morphine, if needed)
- Obtain serum cardiac markers (troponin or CK-MB)
- Identify and treat other conditions that may exacerbate symptoms

Risk Stratification: Non-Invasive Evaluation (Cardiac Stress Test)
Indications for Non-Invasive Evaluation:
- Establish or confirm a diagnosis of ischemic heart disease.
- Estimate prognosis in patients with known or suspected IHD.
- Assess the effects of therapy.

Patients with contraindications to exercise testing should undergo pharmacologic stress testing with an imaging modality.

Establishing diagnoses:
- Is most useful if the pre-test probability of coronary artery disease (CAD) is intermediate (10% to 90%).
- Should generally not be done in patients with very high or very low probabilities of CAD.
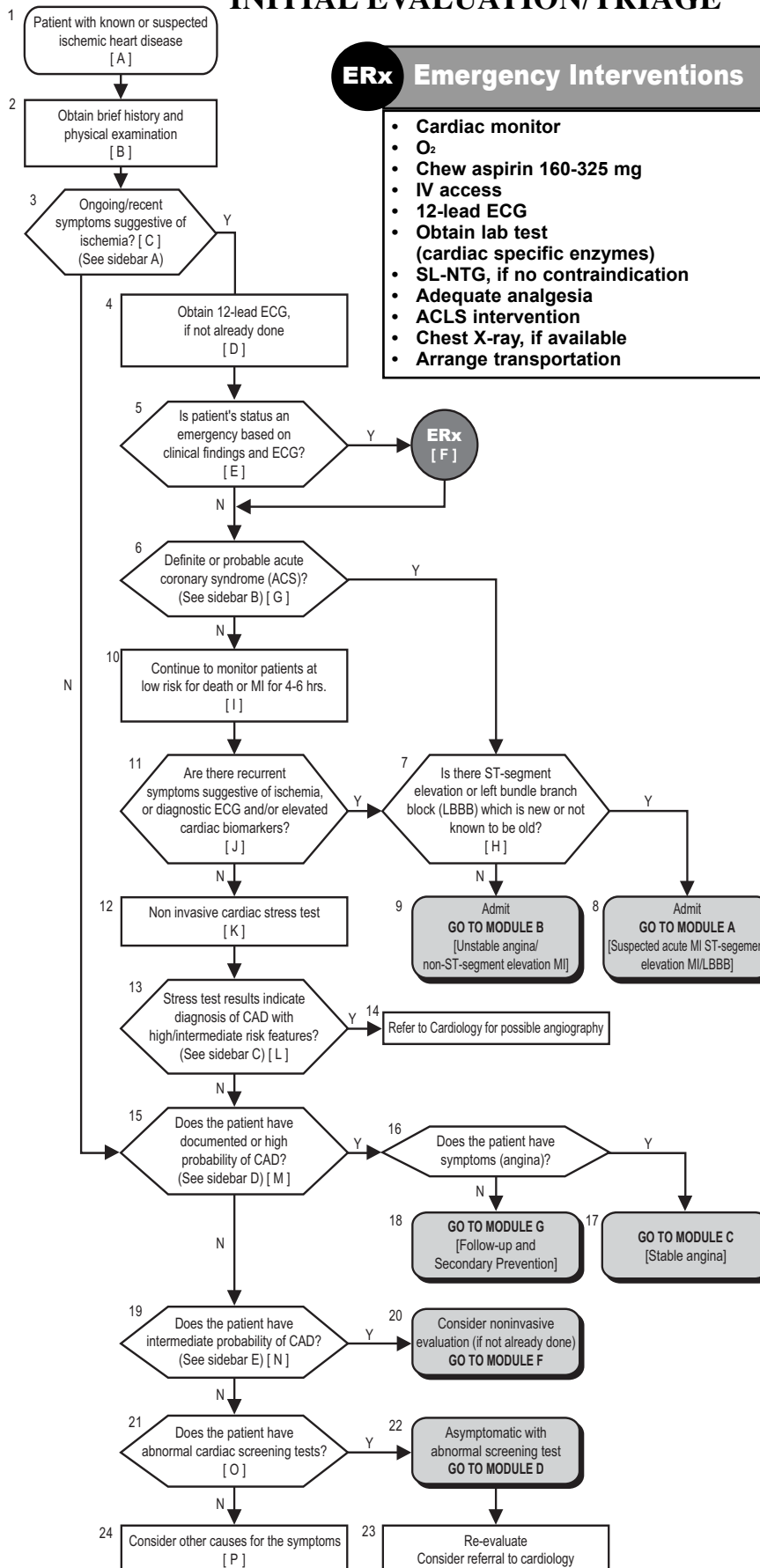
Variables useful in estimating prognosis include:
- Maximum workload achieved
- Heart rate and blood pressure responses to exercise
- Occurrence and degree of ST-segment deviation
- Occurrence and duration of ischemic symptoms
- Size and number of stress-induced myocardial perfusion or wall motion abnormalities

MANAGEMENT OF ISCHEMIC HEART DISEASE
CORE MODULE
INITIAL EVALUATION/TRIAGE

1 Patient with known or suspected ischemic heart disease [A]

↓

2 Obtain brief history and physical examination [B]

↓

3 Ongoing/recent symptoms suggestive of ischemia? [C] (See sidebar A) — Y →

4 Obtain 12-lead ECG, if not already done [D]

↓

5 Is patient's status an emergency based on clinical findings and ECG? [E] — Y → **ERx [F]**

N ↓

6 Definite or probable acute coronary syndrome (ACS)? (See sidebar B) [G] — Y →

N ↓

10 Continue to monitor patients at low risk for death or MI for 4-6 hrs. [I]

↓

11 Are there recurrent symptoms suggestive of ischemia, or diagnostic ECG and/or elevated cardiac biomarkers? [J] — Y →

7 Is there ST-segment elevation or left bundle branch block (LBBB) which is new or not known to be old? [H] — Y →

N ↓ (box 11)   N ↓ (box 7)

12 Non invasive cardiac stress test [K]

9 Admit **GO TO MODULE B** [Unstable angina/ non-ST-segment elevation MI]

8 Admit **GO TO MODULE A** [Suspected acute MI ST-segement elevation MI/LBBB]

↓ (box 12)

13 Stress test results indicate diagnosis of CAD with high/intermediate risk features? (See sidebar C) [L] — Y → **14** Refer to Cardiology for possible angiography

N ↓

15 Does the patient have documented or high probability of CAD? (See sidebar D) [M] — Y → **16** Does the patient have symptoms (angina)? — Y →

N ↓ (box 15)   N ↓ (box 16)

18 GO TO MODULE G [Follow-up and Secondary Prevention]

17 GO TO MODULE C [Stable angina]

↓ (box 15 N)

19 Does the patient have intermediate probability of CAD? (See sidebar E) [N] — Y → **20** Consider noninvasive evaluation (if not already done) **GO TO MODULE F**

N ↓

21 Does the patient have abnormal cardiac screening tests? [O] — Y → **22** Asymptomatic with abnormal screening test **GO TO MODULE D**

N ↓

24 Consider other causes for the symptoms [P]

23 Re-evaluate Consider referral to cardiology

ERx Emergency Interventions

- **Cardiac monitor**
- **O₂**
- **Chew aspirin 160-325 mg**
- **IV access**
- **12-lead ECG**
- **Obtain lab test (cardiac specific enzymes)**
- **SL-NTG, if no contraindication**
- **Adequate analgesia**
- **ACLS intervention**
- **Chest X-ray, if available**
- **Arrange transportation**

Sidebar A (Box 3): Symptoms/Signs Suggesting Ischemia

- Chest pain or severe epigastric pain, nontraumatic in origin, characterized by:
  - Central/substernal compression or crushing chest pain/discomfort
  - Pressure, tightness, heaviness, cramping, burning, aching sensation
  - Unexplained indigestion, belching, epigastric pain
  - Radiating pain in neck, jaw, shoulders, back, or arm(s)
- Associated dyspnea
- Associated nausea and/or vomiting
- Associated diaphoresis

Sidebar B (Box 6): Acute Coronary Syndrome

Any item of LIST A, OR
One item from both LIST B and LIST C

LIST A
- ST-elevation or LBBB and recent (<24 hr) or ongoing angina
- New, or presumably ne, ST-segment depression (>0.05 mV) or T-wave inversion (>0.2 mV) with rest symptoms
- Elevated biomarkers (i.e., troponin I, troponin T, and CK-MB)

LIST B
- Prolonged (>20 min.) chest, arm, or neck discomfort
- New onset chest, arm, or neck discomfort during minimal exertion or ordinary activity (CCS class III or IV)
- Previously documented chest, arm, or neck discomfort which has become distinctly more frequent, longer in duration, or lower in precipitating threshold (i.e., increased by one CCS class or more to at least CCS class II)

LIST C
- Typical or atypical angina
- Male age >40 or female age >60
- Known CAD
- Heart failure, hypotension, or transient mitral regurgitation by examination
- Diabetes mellitus
- Documented extracardiac vascular disease
- Pathologic Q-waves on ECG
- Abnormal ST-segment or T-wave abnormalities not known to be new

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Sidebar C (Box 13): Cardiac Stress Test: High or Intermediate Risk for Cardiac Event

HIGH
- Duke treadmill score ≤-11 (estimated annual mortality >3%)
- Large, stress-induced perfusion defect
- Stress-induced, multiple perfusion defects of moderate size
- Large, fixed perfusion defect with LV dilation or increased lung uptake (thallium-201)
- Stress-induced, moderate perfusion defect with LV dilation or increased lung uptake (thallium-201)
- Echocardiographic wall motion abnormality involving >2 segments at ≤10 mg/kg/min dobutamine or HR <120/min

INTERMEDIATE
- Mild/moderate resting left ventricular dysfunction (LVEF = 0.35 to 0.49)
- Intermediate-risk Duke treadmill score (greater than -11 and less than 5)
- Stress-induced moderate perfusion defect without LV dilation or increased lung uptake (thallium-201)
- Limited stress echocardiographic ischemia with wall motion abnormality only at higher doses of dobutamine involving ≤ two segments

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Sidebar D (Box 15): Definite or High Probability of CAD

- Typical angina in a males age >50 or females age >60
- Prior myocardial infarction or pathologic Q-waves
- Coronary arteriogram with >50% stenosis in >1 vessel(s)
- Prior coronary revascularization (PCI or CABG)
- Left ventricular segmental wall motion abnormality
- Diagnostic evidence of ischemia or infarction on cardiac stress testing

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Sidebar E (Box 19): Intermediate Probability of CAD

- Typical angina in female (age <60) male (age <50)
- Atypical/probable angina in male of any age
- Atypical/probable angina in female age >60
- Noncardiac chest pain in male (age >40) female (age >60)
- Indeterminate finding on cardiac stress testing

CORE MODULE: INITIAL EVALUATION

The purpose of the Core Module is to guide the initial evaluation and treatment of a patient presenting with symptoms possibly due to myocardial ischemia or infarction. Primary emphasis is placed on the rapid identification and early treatment of patients with ST-segment elevation myocardial infarction (STEMI), non-ST-segment elevation myocardial infarction (NSTEMI), and unstable angina. It also provides guidance for the initial diagnosis of stable angina, the asymptomatic patient with an abnormal cardiac screening test, the patient with known coronary artery disease who requires follow-up and attention to prevention of recurrent coronary events, and the non-invasive evaluation of the patient with suspected coronary artery disease. Symptoms of heart failure and arrhythmias are commonly associated with presentation of ACS, however this guideline is not primarily intended to address congestive heart failure (CHF), arrhythmias, or valvular heart disease.

ANNOTATIONS

A. Patient With Known Or Suspected Ischemic Heart Disease (IHD)

Patients managed by this guideline are presenting with non-traumatic chest discomfort or other symptoms that may represent cardiac ischemia or ACS. Symptoms of heart failure and arrhythmias are commonly associated with presentation of ACS, however this guideline is not intended primarily to address congestive heart failure (CHF), arrhythmias, or valvular heart disease.

ANNOTATION

IHD conditions are caused by relative lack of blood flow to the heart. Acute coronary syndromes, such as MI and unstable angina, are acute events precipitated by an unstable atherosclerotic plaque and intra coronary thrombus.

Generally accepted criteria for a diagnosis of IHD, include the following:

- Prior myocardial infarction (MI) and/or pathologic Q-waves on the resting electrocardiogram (ECG)
- Typical stable angina in males age >50 or females age >60
- Cardiac stress test showing evidence of myocardial ischemia or infarction
- Left ventricular (LV) segmental wall motion abnormality by angiography or cardiac ultrasound
- Silent ischemia, defined as reversible ST-segment depression by ambulatory ECG monitoring
- Definite evidence of coronary artery disease (CAD) by angiography
- Prior coronary revascularization (percutaneous coronary intervention [PCI] or coronary artery bypass graft surgery [CABG])

IHD may be suspected in patients who do not meet one of the above criteria, if they have symptoms suggestive of myocardial ischemia or infarction. Although chest pain or discomfort is the classic presentation for stable and unstable angina and for acute myocardial infarction (AMI), other symptoms such as chest heaviness; arm, neck, jaw, elbow, or wrist pain or discomfort; dyspnea; nausea; palpitations; syncope; or nonspecific symptoms (e.g. change in exercise tolerance) can all represent symptoms of IHD. Furthermore, patients may present with non-cardiac problems and undergo an evaluation that reveals significant CAD for which they are asymptomatic.

B. Obtain Brief History And Physical Examination

OBJECTIVE

Obtain the chief complaint and a brief, directed medical history and perform a physical examination, as required, to appropriately triage the patient with known or suspected IHD.

ANNOTATION

Triage personnel (in the clinic, emergency department [ED]), or even over the telephone) must rapidly assess the urgency of a complaint of chest pain or other symptoms that could represent acute ischemia. Vital signs are an essential part of the assessment. Factors such as hypotension, excessive bradycardia or tachycardia, or diaphoresis should prompt triage personnel to initiate emergency interventions (see Annotation D). The physician's physical examination should concentrate on the heart, lungs, and pulses. Historical features of importance include the following: the nature of the pain, onset, duration, provocative and palliative factors, and radiation patterns. The clinician should obtain the following (NHLBI, 1993):

Chief Complaint and History of Present Illness

The history, particularly the chief complaint, is one of the most important steps in the evaluation of the patient with chest pain. A detailed description of the symptom complex enables the clinician to characterize the chest pain (for typical symptoms of myocardial ischemia see Annotation A). Relationship of chest discomfort to exercise or emotion should be ascertained. It is often useful to quantitate the amount of exercise required to precipitate the symptoms and to record the Canadian Cardiovascular Society class (see Table 1). Chest discomfort occurring at rest or awakening the patient from sleep is usually an ominous finding and one of the criteria for ACS.

Past Medical History

The triage nurse or physician should take a brief, targeted, initial history with an assessment of current or past history of the following (this brief history must not delay entry into the Advanced Cardiac Life Support [ACLS] protocol if required):

- Evidence of existing CAD: prior CABG, angioplasty, MI, or abnormal stress test or coronary arteriography
- Change in frequency of nitroglycerin (NTG) use to relieve chest discomfort
- Advanced age and other risk factors (smoking, hyperlipidemia, hypertension, diabetes mellitus, family history, and cocaine use).

Physical Examination

The major objectives of the physical examination are to identify the hemodynamic status and possible comorbid conditions that precipitate or aggravate myocardial ischemia (e.g., aortic stenosis, hypertension, thyrotoxicosis, hypoxia etc.), and the presence of other comorbid conditions that might impact the risk of performing coronary revascularization. Several important aspects of the examination are listed below:

- Vital signs (i.e., blood pressure in both arms, heart rate, respiratory rate, and temperature)
- Evidence of heart failure (i.e., S3 gallop, rales, and elevated jugular venous pressure)
- Evidence of significant mitral or aortic valvular disease
- Evidence of extra-cardiac vascular disease (i.e., bruits or diminished pulses)
- Evidence of non-coronary causes of chest pain (i.e., chest wall tenderness, pericardial or pleural rub, etc.)

C. Ongoing/Recent Symptoms Suggestive Of Ischemia?
OBJECTIVE

Identify patients with myocardial ischemia.

ANNOTATION

Symptoms and signs that may represent myocardial ischemia (NHLBI, 1993; ACC/AHA UA - NSTEMI, 2002) include the following:

- Chest pain or severe epigastric pain, nontraumatic in origin, characterized by:
  - Central/substernal compression or crushing chest pain/discomfort

  - Pressure, tightness, heaviness, cramping, burning, aching sensation
  - Unexplained indigestion, belching, epigastric pain
  - Radiating pain in neck, jaw, shoulders, back, or 1 or both arms
- Associated dyspnea
- Associated nausea and/or vomiting
- Associated diaphoresis

The ACC/AHA UA - NSTEMI (2000) describes the different classes of the Canadian Cardiovascular Society (CCS) classifications as follows:

Table 1. Canadian Cardiovascular Society (CCS) Classification of Angina *

Class I:	**Angina only with *strenuous* exertion** Ordinary physical activity; such as walking or climbing stairs, does not cause angina. —Angina occurs with strenuous, rapid, or prolonged exertion at work or recreation.
Class II:	**Angina with *moderate* exertion** Slight limitation of ordinary activity. —Angina occurs on walking or climbing stairs rapidly; walking uphill; walking or stair climbing after meals; in cold, in wind, or under emotional stress; or only during the few hours after awakening. Angina occurs on walking more than two blocks on the level and climbing more one flight of ordinary stairs at a normal pace and under normal conditions.
Class III:	**Angina with *minimal* exertion or ordinary activity** Marked limitations of ordinary physical activity. —Angina occurs on walking 1 to 2 blocks on the level and climbing 1 flight of stairs under normal conditions and at a normal pace.
Class IV:	**Angina *at rest* or with *any* physical activity** Inability to carry on any physical activity without discomfort. —Anginal symptoms may be present at rest.

* (Campeau, 1976)

D. Obtain 12-Lead ECG, If Not Already Done
OBJECTIVE

Obtain key diagnostic information.

ANNOTATION

A 12-lead ECG is an essential component of the evaluation of the patient with known or suspected IHD. For patients with ongoing symptoms, an urgent ECG should be obtained in the first 10 minutes of the initial evaluation. For patients without ongoing symptoms, an elective 12-lead ECG should be obtained if no prior ECG performed within the past year is available for review, or if there has been an interval worsening of the patient's symptoms. A right-sided ECG should be performed if a standard ECG suggests an inferior wall MI.

E. Is Patient's Status An Emergency Based On Vital Signs And Appearance?
OBJECTIVE

Rapidly triage patients with possible AMI, unstable angina, or unstable hemodynamic status from other causes to a high-acuity setting for rapid diagnostic evaluation and treatment.

ANNOTATION

A patient presenting with chest pain/discomfort in the emergency department should be considered an emergency, if the evaluation reveals (ACEP, 1995):

Patient's vital signs (including one or more of the following):
- Pulse $\geq$110 or $\leq$55 beats per minute
- Systolic blood pressure $\geq$200 or $\leq$90 mm Hg
- Diastolic blood pressure $\geq$110 mm Hg
- Respiratory rate >24 or <10 inspirations per minute
- Oxygen saturation <90%
- Irregular pulse

AND/OR

Patient's appearance (including one or more of the following):
- Is unconscious or lethargic and/or confused
- Has severe respiratory distress or respirations appear labored
- Appears cyanotic, pale or gray

- Appears diaphoretic
- Is in extreme pain or exhibits visible distress

Sudden cardiac death can occur early in any ischemic syndrome. The goals of rapid treatment of MI are to preserve as much myocardium as possible, avoid later complications of heart failure and dysrhythmias, and decrease risk of death.

F. Initiate Emergency Interventions For Patients With Possible Acute Coronary Syndrome (ACS) And Emergent Status
OBJECTIVE

Institute specific interventions that are necessary early in the evaluation and treatment of AMI and unstable angina.

ANNOTATION

1. **Oxygen (O_2)**
   Supplemental oxygen should be administered to all patients with respiratory distress, those with cyanosis or those with documented desaturation. Oxygen should start on initial presentation and during the first 2 to 3 hours and continued if necessary to maintain O_2 saturations of at least 90%. Oxygen may be considered for all patients with suspected ACS. Because oxygen can actually cause systemic vasoconstriction, continued administration should be reassessed for uncomplicated patients. CO_2 retention is not usually a concern with low flow nasal oxygen, even in patients with severe chronic obstructive pulmonary disease (COPD).

2. **Chew aspirin**
   - All patients should chew non-coated aspirin, 160 mg to 325 mg, within 10 minutes of presentation to accelerate absorption
   - If a patient is unable to take aspirin by mouth because of nausea, vomiting, or other gastrointestinal disorders, 325 mg may be given as a suppository.
   - Patients should be given aspirin, even if they are receiving anticoagulation (e.g., warfarin) or antiplatelet (e.g., aspirin or clopidogrel) at the time of presentation.
   - Contraindications to aspirin include a documented allergy to salicylates, active bleeding or active peptic ulcer disease.

- Subsequent aspirin dose of 81-325 mg per day should be given for chronic therapy. Chronic therapy with doses above 81 mg/day is associated with increased bleeding risk without incremental benefit.
- Patients who have an allergy to aspirin and no contraindication to antiplatelet therapy should be given clopidogrel 300 mg loading dose followed by 75 mg daily for at least a month.

3. 12-Lead ECG
A 12-lead ECG is an essential component of the evaluation of the patient with known or suspected IHD. For patients with ongoing symptoms, an urgent ECG should be obtained and interpreted within the first 10 minutes of the initial evaluation and followed up with 2 to 3 serial ECGs in the first 24 hours. EKG should be repeated for recurrent chest pain. For patients without ongoing symptoms, an elective 12-lead ECG should be obtained if no prior ECG performed within the past year is available for review or if there has been a worsening of the patient's symptoms.

4. Intravenous (IV) access
Intravenous access for the delivery of fluids and drugs should be obtained, with both antecubital veins used if possible for multiple infusions, especially if thrombolytic therapy is being considered. While the IV is being started, blood samples for cardiac enzymes/markers (troponin, CK, and CK-MB), lipid profile, complete blood count (CBC), electrolytes, renal function, international normalized ratio (INR), and activated partial thromboplastin time (aPTT) can be obtained. Immediate treatment of ACS should not depend on waiting for these tests.

5. Nitroglycerin (NTG)
NTG should be given for ongoing chest pain or other ischemic symptoms, unless the patient is hypotensive or bradycardic, has taken sildenafil within the last 24 hours, or there is a strong suspicion of right ventricular infarction.

Intravenous nitroglycerin should be considered for 24 to 48 hours in patients with a large MI, persistent ischemia, CHF, or hypertension.

6. Cardiac monitor
Patients with a possible ACS should be placed on continuous electrocardiographic monitoring as soon as possible. Potentially lethal ventricular arrhythmias can occur within seconds to minutes of the onset of coronary ischemia and monitoring will allow their immediate detection and treatment.

7. Adequate analgesia
Adequate analgesia should be given promptly; IV morphine is effective, decreases the often excess sympathetic tone and is a pulmonary vasodilator. Some patients may require a large dose. The patient should be monitored for hypotension and respiratory depression, but these are less likely in the anxious, hyperadrenergic patient who is kept supine.

8. Advanced cardiac life support (ACLS, 2000):
ACLS algorithm should be applied, as indicated.

9. Chest X-ray
A chest x-ray should be obtained in the ED, particularly if there is concern about aortic dissection; however, the treatment of hypotension, low cardiac output, arrhythmias, etc., usually has higher priority.

10. Transportation
In some settings within the DoD or the VA system, the patient will need to be urgently transported to a setting where an appropriate level of monitoring, evaluation and treatment is available.

G. Definite or Probable Acute Coronary Syndrome (ACS)?
OBJECTIVE

Identify patients who may have an ACS (MI or Unstable Angina).

ANNOTATION

New or worsening symptoms suggestive of myocardial ischemia, especially when prolonged or ongoing, should prompt consideration of a possible ACS.

The diagnosis of ACS may be suspected on the basis of a compelling clinical history, specific ECG findings and/or elevations in serum markers of cardiac necrosis (e.g. troponin I, or troponin T, or CPK-MB). The acute coronary syndromes consist of the following three subgroups:

- ST-segment elevation myocardial infarction (STEMI)
- Non-ST-segment elevation myocardial infarction (NSTEMI)
- Unstable angina.

Details regarding the diagnosis and treatment of STEMI are provided in Module A. The pathogenesis and treatment of NSTEMI and unstable angina are similar and are covered in Module B. The following presents a

logical means by which the primary care provider may reach a decision with respect to whether the patient has an ACS and therefore be referred to either Modules A or B for specific management.

Symptoms and signs that may represent acute coronary syndrome (NHLBI, 1993; ACC/AHA UA - NSTEMI, 2002) include the following:

- New onset or worsening prolonged (i.e., >20 minutes) chest, shoulder, arm/shoulder, neck, or epigastric pain, discomfort, pressure, tightness, or heaviness
  - "New onset" is defined as symptoms being evaluated for the first time or the patient with a complaint of chest pain is new to the clinic.
  - "Worsening" is defined as at least a one-class increase (Canadian Cardiovascular Society angina classification) (see Table 1) in a patient with known previous symptoms attributed to myocardial ischemia.
- Radiating pain to the neck, jaw, arms, shoulders, or upper back
- Unexplained or persistent shortness of breath

- Unexplained epigastric pain
- Unexplained indigestion, nausea or vomiting
- Unexplained diaphoresis
- Unexplained weakness, dizziness or loss of consciousness

Diagnosis of Acute Coronary Syndrome

The decision process can be achieved using information derived from a brief, targeted history and physical examination; a 12-lead ECG; and a lab test for cardiac markers. The following two interrelated questions form the basis of the decision process:

1. Do the clinical findings satisfy criteria for an ACS?
2. In the absence of definitive criteria, what is the likelihood (i.e., low, intermediate or high) that the patient's symptoms are due to myocardial ischemia or infarction?

These two questions can be synthesized into a diagnosis of ACS, using Table 5. A diagnosis of ACS may be made if at least *one major criterion* or at least *one minor criterion from each of columns I and II* is present.

Table 5: Criteria Diagnosis of ACS

Major Criteria *A diagnosis of an ACS can be made if one or more of the following major criteria is present*	Minor Criteria *In the absence of a major criterion, a diagnosis of ACS requires the presence of at least one item from both columns*	
	I	**II**
• ST-elevation [a] or LBBB in the setting of recent (<24 hours) or ongoing angina • New, or presumably new, ST-segment depression ($\geq$0.05 mV) or T-wave inversion ($\geq$0. 2 mV) with rest symptoms • Elevated serum markers of myocardial damage (i.e., troponin I, troponin T, and CK-MB)	• Prolonged (i.e., >20 minutes) chest, arm/shoulder, neck, or epigastric discomfort • New onset chest, arm/shoulder, neck, or epigastric discomfort during minimal exertion or ordinary activity (CCS class III or IV) • Previously documented chest, arm/shoulder, neck, or epigastric discomfort which has become distinctly more frequent, longer in duration, or lower in precipitating threshold (i.e., increased by $\geq$1 CCS class to at least CCS III severity)	• Typical or atypical angina [b] • Male age >40 or female age >60 [c] • Known CAD • Heart failure, hypotension or transient mitral regurgitation by examination • Diabetes • Documented extra-cardiac vascular disease • Pathologic Q-waves on ECG • Abnormal ST-segment or T-wave abnormalities not known to be new

[a] *ST elevation $\geq$0.2 mV at the J-point in two or more contiguous chest leads (V_1 to V_6) or $\geq$ 0.1 mV in all other leads. Contiguity in the limb leads (frontal plane) is defined by the lead sequence: I, aVL (lateral), and II, III, aVF (inferior).*

[b] *Use definitions in Table 6 to determine the likelihood that the presenting symptoms are angina*

[c] *These age and gender characteristics define a probability of CAD $\geq$10% in symptomatic patients (See Table 7).*

Table 6: Definitions of Angina Symptoms

Typical angina (definite)	IF all three of the primary symptom characteristics are present
Atypical angina (probable)	IF any two of the primary three symptom characteristics are present
Probably non-cardiac chest pain	IF provocation by exertion or emotional distress or relief by rest or nitroglycerin are present and one or more symptom characteristics suggesting non-cardiac pain are present
Definitely non-cardiac chest pain	IF none of the primary symptom characteristics are present and one or more symptom characteristics suggesting non-cardiac pain are present

The three primary symptom characteristics:
- Substernal chest or arm discomfort with a *characteristic* quality and duration
- Provoked by exertion or emotional stress
- Relieved by rest or nitroglycerin

Symptom *characteristics* that suggest non-cardiac pain, include the following: (but do not exclude a diagnosis of CAD)
- Pleuritic pain (i.e., sharp or knife-like pain brought on by respiratory movements or cough)
- Primary or sole location of discomfort in the middle or lower abdominal regions
- Pain that may be localized at the tip of one finger, particularly over costochondral junctions or the left ventricular (LV) apex
- Pain reproduced with movement or palpation of the chest wall or arms
- Constant pain that lasts for many hours
- Very brief episodes of pain that last a few seconds or less
- Pain that radiates into the lower extremities

(Modified from the ACC/AHA Stable Angina Guideline [1999], Table 5 and ACC/AHA UA - NSTEMI guideline [2002], pages 11-12).

H. Is There ST-Segment Elevation Or New or Presumably New Left Bundle Branch Block (LBBB) With Ongoing/Recent Symptoms?

OBJECTIVE

Determine whether emergent reperfusion therapy may be appropriate.

ANNOTATION

Patients with ST-segment elevation, true posterior MI, or a LBBB that is new or not known to be old, and with symptoms consistent with myocardial ischemia or infarction should be considered for emergent reperfusion therapy. These patients should receive urgent therapy for AMI as delineated in Module A. Patients with non-ST-elevation-acute coronary syndrome (NSTE-ACS) should be admitted and receive urgent therapy for NSTEMI/UA that is covered in Module B.

I. Continue to Monitor Patients at Low-Risk for Death or MI

OBJECTIVE

Monitor low risk patients who may subsequently develop ACS

ANNOTATION

Unstable Angina with Low Risk

For patients with suspected ACS who, at initial presentation, do not have clinical features suggesting intermediate- or high-risk for death or MI, the following are recommended:

- Initial treatment with 160 mg to 325 mg of chewable aspirin
- Initial treatment with sublingual NTG for angina or suspected anginal equivalents
- Continuous ECG monitoring and continued surveillance of vital signs and for recurrent symptoms, for at least 6 to 12 hours, in an appropriate facility-specific unit
- A 12-lead ECG at the time of admission and at least 6 hours from the onset of symptoms, or as needed at change of symptoms or clinical status
- Assessment of serum cardiac biomarkers (troponin, CPK-MB) at the time of presentation. For patients with normal cardiac markers within 6 hours of symptom onset, another sample should be obtained over the subsequent 6-12 hours.

- Early stress testing for patients who do not develop clinical indicators of intermediate- or high-risk by the end of the monitoring period
- Hospital admission and intensification of medical therapy for patients who develop clinical indicators of intermediate- or high-risk by the end of the monitoring period

J. Are There Recurrent Symptoms Suggestive of Ischemia, or Diagnostic ECG and/or Elevated Cardiac Markers?

OBJECTIVE

Identify patients with ACS

ANNOTATION

Patients with recurrent symptoms, positive cardiac specific markers, or evolutionary or dynamic ECG changes during the monitoring period are now demonstrated to have probable or definite ACS and considered at intermediate- or high-risk for death or MI. These patients should receive urgent therapy for ACS as delineated in Module A (STEMI) or B (NSTEMI/Unstable Angina), as appropriate.

Patients who do not develop these features, remain at low risk, and may proceed to stress testing, either immediately before discharge from the hospital or chest pain unit, or after discharge and within 72 hours.

K. Non-Invasive Cardiac Stress Test

OBJECTIVE

Determine the presence or absence of ischemia in patients with a low likelihood of CAD

ANNOTATION

Patients who are pain-free, have a normal/unchanged ECG and a normal initial cardiac marker measurement should have a follow-up ECG and repeat cardiac marker measurement after 6 – 8 hours. Those patients, who remain pain-free with no ECG changes and negative cardiac marker measurements, should undergo a cardiac stress test either before discharge or within 72 hours to separate patients with nonischemic discomfort from those with low risk ACS. This information is key for the development of further diagnostic steps and therapeutic measures

Patients with NSTE-ACS who have been stabilized on medical therapy, but who are found to have LV dysfunction, may benefit from further risk stratification using coronary angiography to assess their hemodynamic status and to determine their likelihood of benefit from revascularization.

A detailed discussion of noninvasive stress testing in CAD is presented in Module F

L. Stress Test Results Indicate Diagnosis of CAD with High/Intermediate Risk Features
OBJECTIVE

Refer patients who may benefit from coronary angiography or revascularization.

ANNOTATION

Patients with high or intermediate risk features on noninvasive stress testing may benefit from coronary angiography and subsequent coronary revascularization and should be referred to a specialist in cardiovascular diseases.

The following list includes examples of non-invasive test results that indicate high or intermediate risk, for which cardiology referral for coronary angiography should be considered (adapted from ACC/AHA Guidelines for Coronary Angiography: Executive Summary and Recommendations, 1999).

High-Risk:

- Severe resting LV dysfunction (LVEF <0.35)
- High-risk Duke treadmill score (score $\leq$-11)
- Severe exercise LV dysfunction (exercise LVEF <0.35)
- Stress-induced large perfusion defect (particularly if anterior)
- Stress-induced moderate-size multiple perfusion defects
- Large, fixed perfusion defect with LV dilatation or increased lung uptake (thallium-201)
- Stress-induced moderate-size perfusion defect with LV dilatation or increased lung uptake (thallium-201)
- Echocardiographic wall motion abnormality (involving >2 segments) developing at low dose of dobutamine ($\leq$10 mg/kg/min) or at a low heart rate (<120 bpm)
- Stress echocardiographic evidence of extensive ischemia

Intermediate-Risk:

- Mild/moderate resting left ventricular dysfunction (LVEF = 0.35 to 0.49)
- Intermediate-risk treadmill score (greater than –11 and less than 5)
- Stress-induced moderate perfusion defect without LV dilation or increased lung intake (thallium-201)
- Limited stress echocardiographic ischemia with a wall motion abnormality only at higher doses of dobutamine involving less than or equal to two segments

Patients with high or intermediate risk features on stress testing may benefit from further risk stratification using coronary angiography to determine their likelihood of benefit from revascularization. The decision about coronary revascularization resides with a specialist in cardiovascular diseases, since this specialist is in the best position to discuss the relative risks and benefits of bypass surgery versus medical therapy or percutaneous coronary revascularization.

The survival benefits of myocardial revascularization are most pronounced among patients with LV dysfunction. Therefore, all patients with NSTEMI/UA who are found to have a reduced EF (<0.40) on non-invasive testing should be considered for referral to cardiology for possible coronary angiography and subsequent revascularization (AHA/ACC UA – NSTEMI, 2002). This recommendation applies even to patients who do not have clinical signs and symptoms of heart failure and to those whose ischemic symptoms have been stabilized.

M. Does The Patient Have Documented IHD Or A High Probability Of CAD?
OBJECTIVE

For patients who do not meet criteria for an ACS, identify those who have CAD or a high probability of CAD.

ANNOTATION

Known CAD

For purposes of this guideline, a patient may be considered to have a "known" CAD if any of the following exist:

- Prior coronary revascularization procedure (PCI or CABG)

- Prior documented MI
- Prior coronary angiogram demonstrating an obstructive CAD (>50% left main stenosis and/or >70% stenosis of a major epicardial artery)
- Prior non-invasive test indicating a high probability of CAD (see also Module F):
  - Pathologic Q-waves (>0.04 seconds duration and >25% of the height of the R-wave) on a standard resting ECG (except leads III, aVR, and V₁)
  - Greater than 1mm horizontal or down sloping ST-segment depression on exercise electrocardiography—Medium- or large-sized fixed or reversible defect on myocardial perfusion imaging (e.g., thallium)
  - Segmental wall motion abnormalities by cardiac ultrasound examination or LV angiography
  - Inducible, segmental wall motion abnormalities on stress echocardiography

- Silent ischemia, defined as reversible ST-segment depression by ambulatory ECG monitoring

Probability of CAD

For patients who do not have documented CAD, the likelihood that a patient's symptoms are due to CAD is estimated using only age, gender and the character of the symptoms. For instance, typical angina in a male older than 50 years indicates high probability of CAD. The pretest likelihood of CAD is presented in Table 7. It should be reemphasized that Table 7 *applies only to patients who do not have ACS*. The table is based on data from the ACC/AHA Stable Angina (2003) guideline, (Table 9: Pretest Likelihood of CAD in Symptomatic Patients According to Age and Sex). The ECG and serum markers of myocardial necrosis are not considered.

Table 7. Pretest Likelihood of CAD in Symptomatic Patients According to Age and Sex* (Combined Diamond/Forrester [1979] and CASS Data)

Age (Years)[a]	Non-anginal Chest Pain[b]		Atypical (Probable) Angina[b]		Typical (Definite) Angina[b]	
	Men	Women	Men	Women	Men	Women
30-39	4	2	34	12	76	26
40-49	13	3	51	22	87	55
50-59	20	7	65	31	93	73
60-69	27	14	72	51	94	86

Each value represents the percent with significant CAD on catheterization.

(a) *No data exist for patients less than 30 years or greater than 69 years, but it can be assumed that prevalence of CAD increases with age. In a few cases, patients with ages at the extremes of the decades listed may have probabilities slightly outside the high or low range.*

(b) *Definitions Used In The Classification Of Symptoms Into Typical/Definite Angina, Atypical/Probable Angina, And Non-Anginal Chest Pain:*

Typical angina (definite)	IF all three of the primary symptom characteristics are present
Atypical angina (probable)	IF any two of the primary three symptom characteristics are present
Probably non-cardiac chest pain	IF provocation by exertion or emotional distress or relief by rest or nitroglycerin are present and one or more symptom characteristics suggesting non-cardiac pain are present
Definitely non-cardiac chest pain	IF none of the primary symptom characteristics are present and one or more symptom characteristics suggesting non-cardiac pain are present

N. Does The Patient Have Intermediate Probability Of CAD?

OBJECTIVE

Identify patients who have symptoms with an intermediate likelihood of CAD.

ANNOTATION

Patients who do not have a documented CAD, but the likelihood that the symptoms are due to CAD is intermediate (using age, gender and the character of the symptoms in Table 7), should be referred for noninvasive evaluation to rule out or confirm the diagnosis of CAD (see Module F).

O. Does The Patient Have A Low Probability of CAD but Abnormal Cardiac Screening Tests?

OBJECTIVE

Consider evaluating specific asymptomatic patients who have abnormal cardiac screening tests.

ANNOTATION

In general, asymptomatic patients with normal ECGs do not warrant further evaluation for IHD. However, patients may seek guidance from their primary physician regarding abnormalities in cardiac tests performed elsewhere. Non-invasive testing for CAD is being performed with increasing regularity in asymptomatic individuals—both because of the concern of an association between subclinical ("silent") CAD and an increased risk of coronary events, and of advances in techniques used to detect occult CAD. The testing may be done as part of a routine physical examination, an exercise program, a preoperative evaluation, an evaluation performed for peripheral or cerebral vascular disease, or by patient request. Patients with a low probability of CAD (e.g., asymptomatic or atypical/probably non-cardiac chest pain) but abnormal cardiac screening tests may warrant cardiology evaluation for need for further testing (Module D).

P. Consider Other Causes For The Symptoms

OBJECTIVE

Consider both cardiac (non-ischemic) and non-cardiac causes of the patient's chest discomfort.

ANNOTATION

Although the primary goal of the Core Module is to evaluate for ischemic sources of chest discomfort, the patient's complaints deserve investigation even if ischemia is ruled out. In many instances, the source of non-cardiac chest discomfort will be obvious from the history (e.g., ascending midline pain associated with reflux of acid into the mouth and relieved entirely by antacids) or physical examination (e.g., the presence of dermatomal blisters in herpes zoster). Also, the physician must keep in mind that other cardiac diseases (such as pericarditis or valvular heart disease) can present with chest pain.

A thorough history, physical examination and review of symptoms, appropriate lab testing, and occasionally, an empiric trial of specific therapy may be necessary to confirm an alternative diagnosis. In many instances, no specific diagnosis will be made. The patient, however, will usually be reassured to know that the symptoms do not have a cardiac source. However, other risk factors for cardiovascular diseases should be addressed including screening for smoking, hypertension, diabetes, lipid profile and lifestyle modification.

Table 8. Alternative Diagnoses to Angina for Patients with Chest Pain or Discomfort
(adapted from ACC/AHA Stable Angina, 1999)

Nonischemic Cardiovascular	Pulmonary	Gastrointestinal	Chest Wall	Psychiatric

• Aortic dissection
• Pericarditis
	• Pulmonary embolus
	• Pneumothorax
	• Pneumonia
	• Pleuritis
		• Esophageal
		  —Esophagitis
		  —Spasm
		  —Reflux
		• Biliary
		  —Colic
		  —Cholecystitis
		  —Choledo-cholithiasis
		  —Cholangitis
		• Peptic ulcer
		• Pancreatitis
			• Costochondritis
			• Fibrositis
			• Rib Fracture
			• Sternoclavicular arthritis
			• Herpes zoster (before the rash)
				• Anxiety disorder
				  —Hyperventilation
				  —Panic disorder
				  —Primary anxiety
				• Affective disorders (e.g., depression)
				• Somatoform disorders
				• Thought disorders (e.g., fixed delusion)